



Format and Location Agnostic Image Data Access Subsystem for Data Intensive Investigations

PI : Lucian Plesea, JPL

Objective

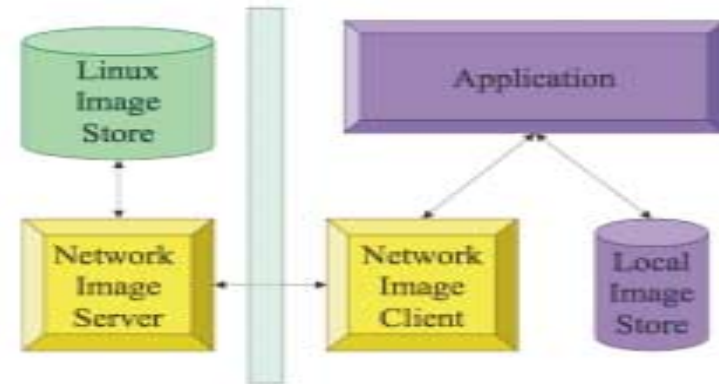
- Build a collection of tools and protocols for 2D and 3D uniform grid data access that hides from the application the real location and storage format of the data.
- Enable data access to remote data via a image network protocol for the National Virtual Observatory (NVO) mosaic service
- Build an uniform image layer access for various image data formats (FITS, OpenGIS, geoTIFF, JPEG, ...)
- Merge the image access subsystem into the grid computing environment

Approach

- Develop a network image protocol for 2D, 3D image data and metadata, with SGI IRIX and Linux client and server implementations
- Incorporate support into the NVO mosaic application
- Use GLOBUS grid computing tools for computing grid support

Partners: NVO/IPG team: J.Jacob,
J.Collier, L.Craymer, D. Curkendall/JPL

Data Access



Key Milestones

- | | |
|---|------|
| • Image Network prototype implementation | 9/02 |
| • Image Data Layer in NVO mosaic application | 2/03 |
| • Linux client support via libtiff and libjpeg standard libraries | 9/03 |
| • Grid authentication support for NVO | 2/04 |

TRL_{in} =5



Format and Location Agnostic Image Data Access

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Objective

- Improve access of high performance applications to large image data resources
- Establish a network transfer protocol tuned for image access for improved access to data stored on remote machines of different architectures.
- Separate the data storage format details from the main application.
- Enable high performance pipelining of data processing applications by using the same access method to local data files or remote data producing applications



Real picture of a mountain lake and hydroelectric dam



Image combining LandSat 7 data and SRTM elevation, produced and served using the Image Access Layer

Accomplishments

- Developed the Network Image Protocol for performing data intensive processing using remote data storage resources
 - Protocol enables local or remote access to data in the application's required data format by doing translation on the fly
 - The application doesn't need to know anything about the details of the data or its location
 - Time consuming data staging is completely eliminated – allowing an application to be moved to another computer without moving the data
- Implemented the the Image Access Layer software, which was used in the production of the 5TB Web Map Service (WMS) LandSat 7 Global Mosaic
 - Used 50,000 cpu-hrs of computing resources located at NASA ARC to mosaic the LandSat scenes
 - The input and output datasets were located at JPL – no data staging took place!
- The Image Access Layer is used for data access and low level processing by the public OnEarth WMS Server, producing more than three million maps every day. The server is an IRIX computer that serves data residing on multiple Linux computers via the Network Image Protocol.
- Legacy applications tied to specific computer architectures can now be linked together by a data exchange protocol without significant performance penalties, and as an alternative to a lengthy and expensive software port

TRL_{in} =5; TRL_{out}=6

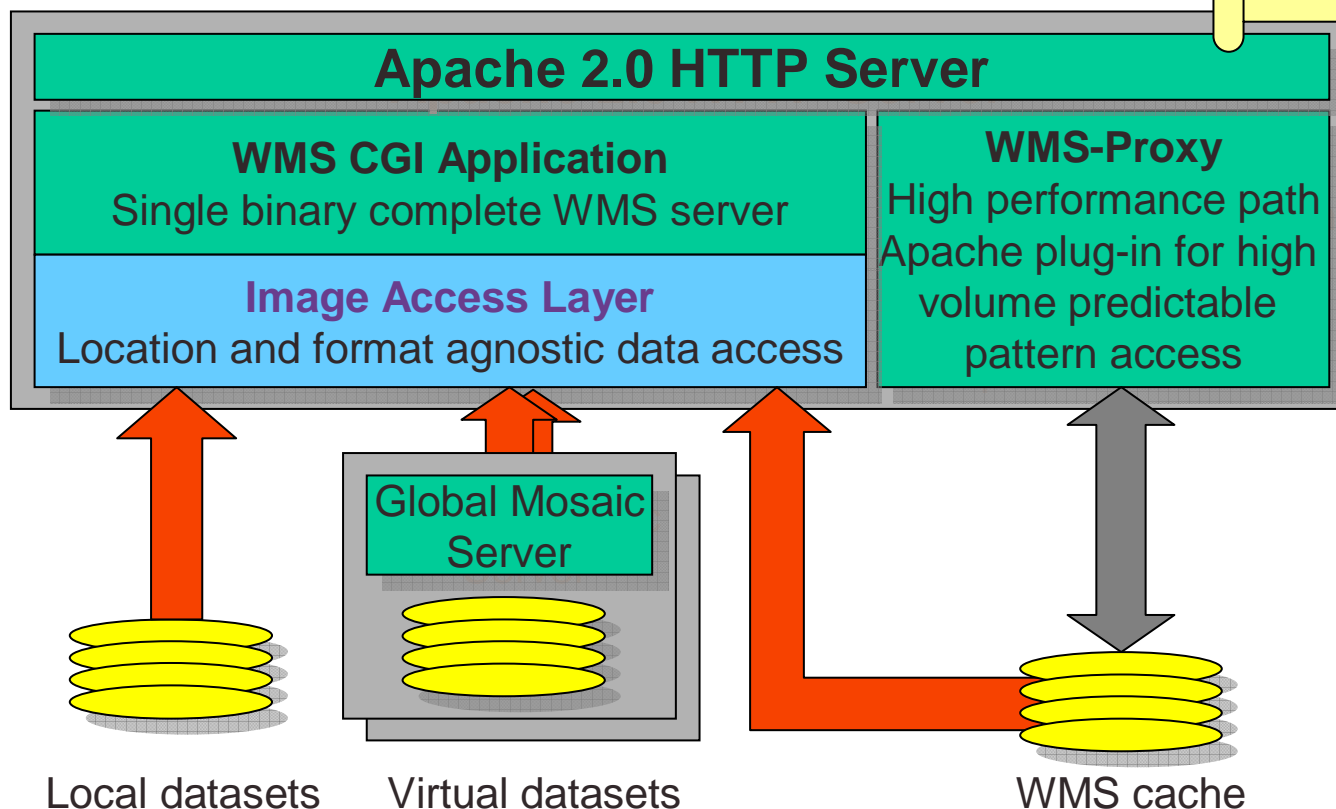
1/26/05 Monthly





OnEarth WMS Server Architecture

*Recipient of NASA
Space Act Board
Award, Nov 2004*

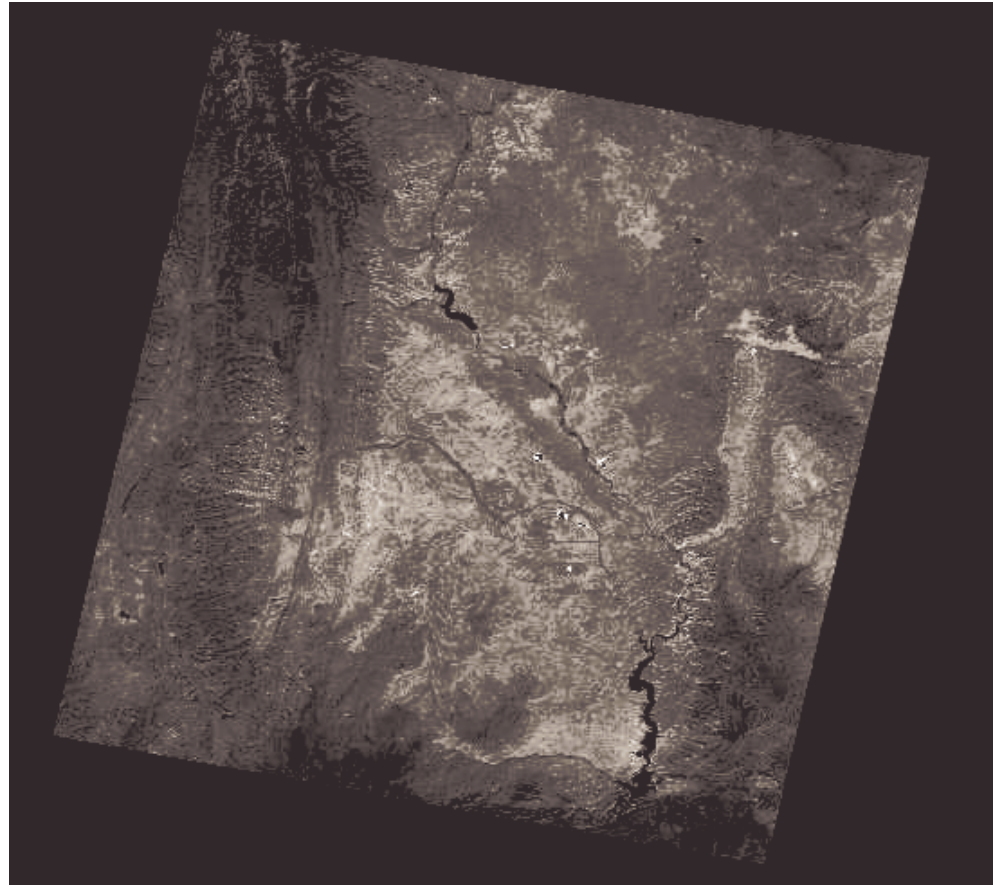


The OnEarth WMS Server is built around the Image Access Layer, including the Image Network Protocol, represented by the red arrows. The Global Mosaic Servers are virtual datasets (on Linux computers), an example of a remote pipelined application working on different architectures.



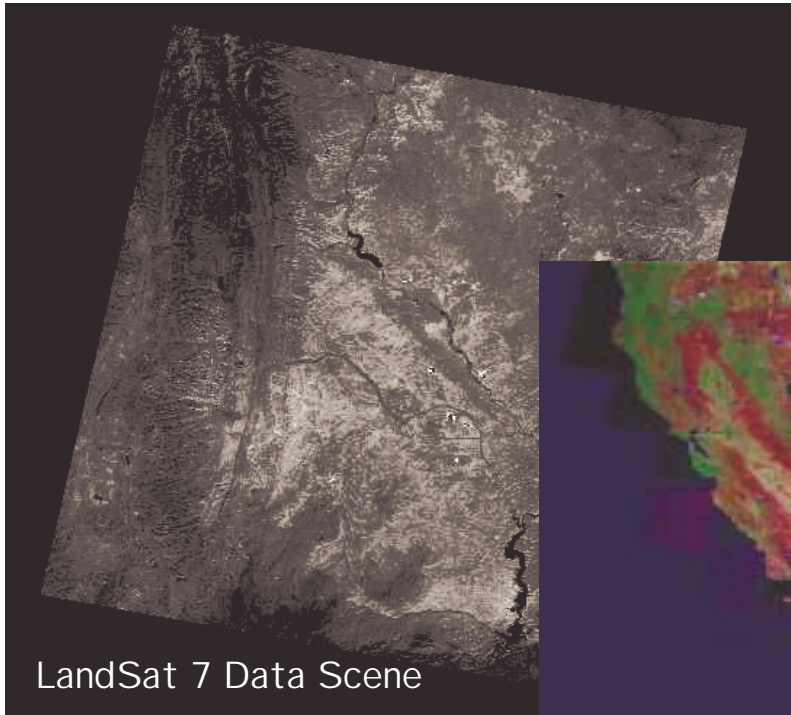
LandSat 7 Scenes

Raw data is provided in very large files covering an arbitrary area, separated by band and in a default projection. Converting this raw data to what the user actually needs in terms of coverage, resolution, aspect and projection is a significant problem.



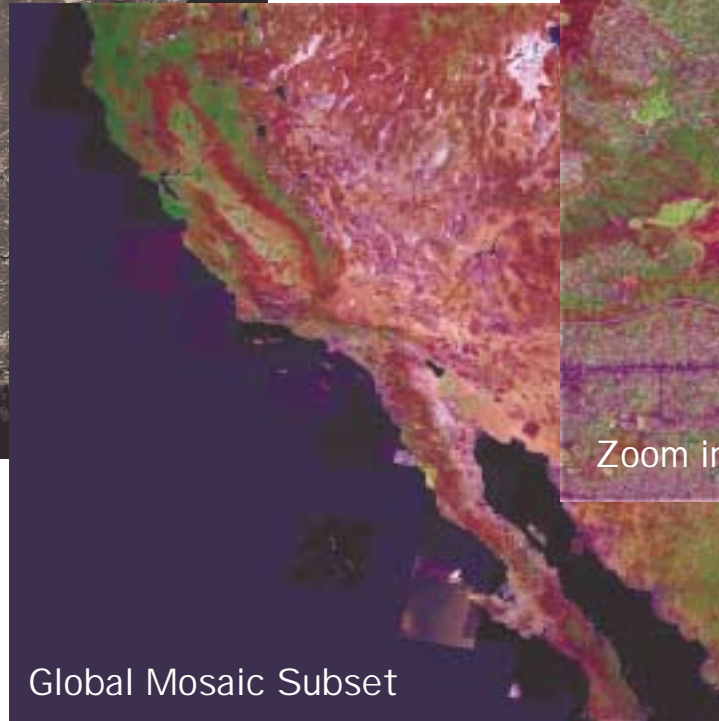


OnEarth WMS Server Products

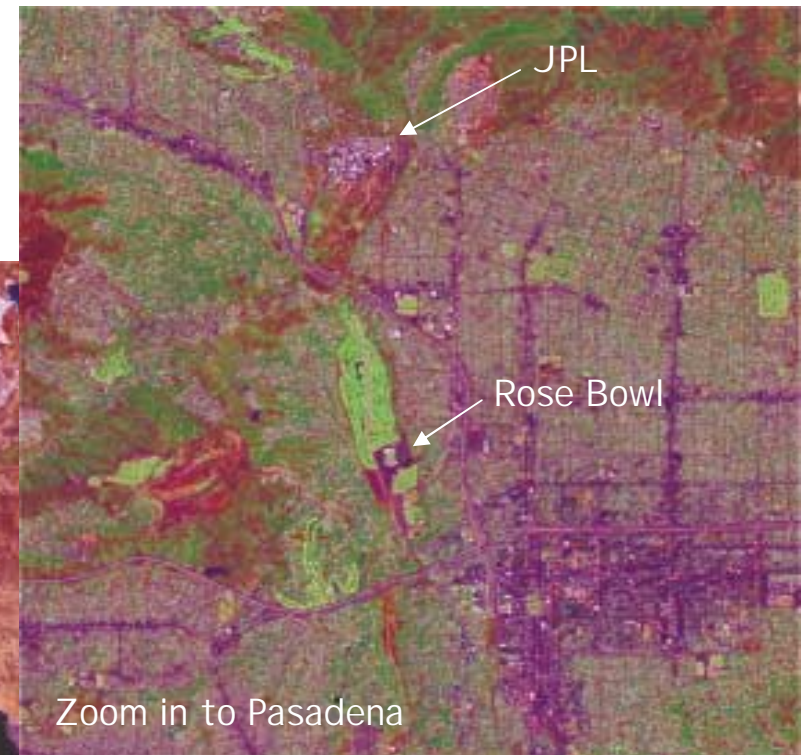


LandSat 7 Data Scene

The Image Access Layer was used to produce a global mosaic of LandSat 7 data, including reprojection, color blending, etc.



Global Mosaic Subset



Zoom in to Pasadena

The Image Access Layer is used in real time to subset, scale, reproject and colorized based on a user's requirements via the WMS protocol.

Within six months of the public availability on the web, the ease of access and flexibility of this approach made it possible to access this 5TB dataset by advanced clients such as ESRI's ArcView and NASA Learning Technologies' WorldWind.



Image Access Layer in Production Processing

A third party application, in this case the Intergraph OGC WMS Viewer, showing the daily MODIS composite and other datasets.

Two of these global 250m MODIS composite image layers are built every night by another application using the **Image Access Layer**. These applications are built fully independently of the server, yet can make use of new data via the WMS ISO standard





Data Product Example

This image is a screenshot of WorldWind, a real-time WMS client of the OnEarth WMS server built using the image access layer. The Landsat image and the SRTM elevation were produced and stored using the Image Access Layer



3D view of Mt. St. Helens



Data Product Example



Simulated images using Landsat and SRTM. The different spectral views are produced in real time by a pipelined Linux/IRIX system under the control of the user. The smaller picture on the right was taken from a commercial flight.





World Mosaic From LandSat 7 Data

